March 28, 2006

To: Distribution
From: GDE Change Control Board
Subject: Response to the Change Request for the BCD RTML section

Preamble

This is the CCB response to the proposed change on the Ring-To-Main-Linacs sections of the March 3, 2006 version of GDE ILC Baseline Configuration Document [1]. CCB received this change request from P.Tenenbaum on March 20, 2006 [2], and CCB forwarded it to GDE the same day. This Change Request was treated as Class-1. K.Kubo and D.Schulte were assigned as the CCB reviewer.

Summary

The request clarifies the description on the beam measurement station at the upstream end of the RTML. In the new description, the previous requirement for intra-bunch emittance measurement for this station is dropped, and the station is stated to use either a metal wire scanner or an OTR screen.

A discussion ensued between the members of CCB and the requester on elimination of a non-invasive, intra-bunch-capable emittance measurement device at the portion of RTML in question. This proposal came about partially because of the technical difficulties there of implementing laser-wire monitor which is the only viable solution for achieving full-current, intra-bunch measurements at this moment. (*Note* that non-full-current, invasive measurement capabilities are retained). CCB has reached an agreement with the requester that most of the beam tuning in standard operation can be supported by a combination of downstream wire scanners and the monitors within the damping rings.

A remaining issue is the one foreseen during the commissioning stage where potential sources of emittance growth in an early part of RTML is searched for. CCB feels that at that stage the proposed metallic wire scanner or OTR may suffice the purposes. See Appendices 1 and 2 for part of the communication concerning this topic.

For these reasons, the CCB agrees with and accepts the proposed change request as is.

References

[1] http://www.linearcollider.org/wiki/doku.php?id=bcd:bcd_home .
[2] http://www.linearcollider.org/wiki/doku.php?id=bcd:bcd_history ,
http://lcdev.kek.jp/ML/PubCCB/msg00043.html .

Appendix 1.

Subject: RE: [Ext-GDE-28] RTML BC Change Request
From: Daniel Schulte
To: N.Toge
Date: Thu, 23 Mar 2006 09:00:37 +0100
Keywords: CERN SpamKiller Note: -49 Charset: west-latin
Thread-Topic: [Ext-GDE-28] RTML BC Change Request
Thread-Index: AcZMcLzvoqujlmSkQw6loOHGmf0vfQB2ztYm

Dear Nobu,

the changes seem quite acceptable to me. The only point I would like to raise is the fact that the conventional wires do not allow to measure at full intensity. A system is required (I think) that can measure at least any part of the train. It may be possible to do this by extracting different parts of the pulse from the damping ring. I would think that therefore it seems useful to add that the use of the wire system needs to be studied to make sure that the solution is sufficient.

Cheers,
Daniel.

Appendix 2.

Subject: Re: Fw: [Ext-GDE-28] RTML BC Change Request
From: Peter Tenenbaum
To: N.Toge
CC: Daniel Schulte
Date: Thu, 23 Mar 2006 15:52:49 -0800
User-Agent: Thunderbird 1.5 (Windows/20051201)

A few comments on this:

1. Clive Field et al reported at the 1998 Beam Instrumentation workshop on wire scanner failure under conditions of high intensity beams. One of the wire scanners they reported on was a 7 μm carbon wire which performed over 5000 scans without failure at a charge density of 2.5×10^8 particles/μm^2. Under nominal conditions the charge density of the full train at the proposed location of the wire scanner is 3.8×10^9 particles/ μm^2. We don't know much about the behavior of wires at this intensity simply because we've never managed to get there. On the one hand our experience is only a factor of 10 away; on the other hand, it's a factor of 10 away! So I would agree that there is no guarantee that the wire at this location will be capable of performing scans in which the entire train is extracted but the emittance of only selected bunches is considered.

2. On the other hand: the only technology we have in hand which shows much promise for tolerating beam densities above the failure point of carbon wires is the laser wire. In my request I argued that a laser wire is not likely to work in this location because of the difficulties in extracting the signal.

3. Then again, we have the laser wires on the other side of the turnaround, which presumably can be designed to meet Daniel's requirements. Personally I cannot imagine a situation in which we need to measure the bunch-by-bunch emittance in the RTML and cannot be satisfied by the wires after the turnaround. After all, the whole point of emittance growth is that, barring tuning, it is permanent.

4. The damping ring will presumably have its own intra-train emittance measurement capabilities for the stored beam and will not rely upon measurements of the extracted beam to diagnose problems with the stored beam. So the damping ring tuning will not require bunch-by-bunch emittance measurement in the RTML near the extraction point.

5. If on the other hand the later bunches are damaged because they follow a different orbit through the septum, then this will become apparent when we correlate the bunch-by-bunch emittance after the turnaround with the bunch-by-bunch extraction line orbit. Again, we do not need the measurement near the extraction point.

In sum, my judgement is that the capability to perform bunch-by-bunch emittance measurements within a train is present in the wires downstream of the turnaround, and we do not need to duplicate this capability in the diagnostics just after the DRX.

-PT

END